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SCIENCE

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THE NAPLES ZOOLOGICAL STATION

ON a recent visit to Naples the writer discussed with Professor Filippo Bottazzi details of the war management of the Naples Zoological Station and its proposed future disposition—a subject that will be of interest to the readers of SCIENCE.

In the train of events following May, 1815, R. Dohrn, director of the station, and all the German personnel, departed. The zoological station was taken over by the Italian government. The management was placed under the administration of a special commission composed of Professor F. S. Monticelli, of the University of Naples; Professor L. De Marchi, of the University of Padua, and Comm. G. Biraghi, department chief of the Ministry of Education. Professor Monticelli was made president of the commission. This commission then appointed Professor U. Pierantoni, of the University of Naples, director of the zoological section of the station; Professor F. Bottazzi, of the University of Naples, director of the physiological section, and some other assistants.

By a decree May 26, 1918, the commission placed the station under the auspices of the Ministry of Education as an autonomous institution; and by another decree, June 9, 1918, the statute compiled by the commission itself was approved and now governs the administrative management of the station.

The part of the statute which concerns the scientific management of the station has aroused objections from those interested in the physiology and physiological chemistry sections, as there was a feeling that in time these two sections would be overshadowed. Without going into the details of the discussion of this portion of the statute, for the formation of which the president of the commission seems to have been solely responsible, it suffices to

say that at present the main objection is the method of appointing the scientific staff and of apportioning the appropriations among the different sections. The director of the station, who, according to the now existing statute, must be a zoologist, has sole control of the recommendation for the appointment and discharge of the entire scientific staff, assistants, and other attendants, and also makes recommendations for the financing of the station.

The station is now—and has been since the approval of the decree by the commission, June, 1918—under the direct supervision of the Ministry of Education. This is a temporary arrangement and will continue until June, 1921.

A committee of eleven has lately been appointed to formulate a plan for the future organization of the station. Of these, three never took part, and two others were called away on urgent business after the beginning of the deliberations. Of the six who participated in the discussion, five—Professor V. Volterra (Rome), Professor P. Del Pezzo (Naples), Professor D. Carazzi (Florence), Professor F. Bottazzi (Naples), and Comm. Martini (of the Ministry of Education)—made a majority report, May, 1920, with one—Professor F. S. Monticelli—dissenting.

The committee recommend that the zoological station be an autonomous institution open to Italian and foreign investigators alike. They also recommend that the state provide an annual subsidiary for the maintenance of the station to be divided, as recommended by the commission, between the Ministry of Education, the Committee on Oceanography, and the Ministry of Agriculture, all of which are interested in the future welfare of the station.

The station would thus be of the same character as other autonomous institutions, having an organization which would presuppose its administrative and scientific autonomy; and at the same time the Italian government would support it with annual appropriations. Each contributing organization of the state would reserve a given number of tables for its investigators.

The committee also recommend that the rules and regulations now in force be retained, and changes be made only where necessary to carry out the plans as set forth in the report. The most important change is that in the statute relating to the appointment of the director of the station and the scientific personnel. The committee recommend modifications that will guarantee the stability and welfare of all the sections of the station. The scientific personnel is to be placed on the same footing as that of civil employees of the state.

The essential points of the statute recommended by the committee can be briefly stated:

1. The station is to be—as approved by the decree of May 26, 1918—an autonomous institution for the investigation of marine biology; open alike, and on the same basis, to Italians and foreigners.

2. The station is to have the full control and the use of all funds and property belonging to it as proclaimed by the municipality of Naples, July 30, 1917.

3. The sources of income are to be:

(a) Appropriations of the Ministry of Education.

(b) Appropriations of the Committee on Oceanography.

(c) Appropriations of the Ministry of Agriculture.

(d) Appropriations of the Municipality of Naples.

(e) Proceeds of public contributions and from Italian and foreign institutions.

(f) Proceeds from the fees of admission to the public aquarium.

(g) Proceeds from tables secured by Italians and foreigners for study.

(h) All other sources.

4. The station will administer its own funds.

5. The station is to have a council of administration composed thus:

(a) Three members appointed by the municipality of Naples. The mayor is president *ex officio*.

(b) Three members appointed by the Ministry of Education.

(c) Three members appointed by the Committee on Oceanography.

(d) One member appointed by the Ministry of Agriculture.

(e) The director of the station.

This council is to have charge of the financing and the administration of the station.

6. Each regular contributor will be allowed to take part in the administration of the station and, according to the rules of the statute, will be given tables in proportion to the contribution.

7. The director legally represents the station and is responsible to the council of administration.

8. The station is composed of sections of zoology, physiology, and physiological chemistry. The council of administration has the power to organize other sections within certain specifications.

9. The scientific staff is composed of the directors of the various sections of the station, the assistants, and librarian.

10. The directors of the different sections are chosen through competing examinations following the general rules governing the university competing examinations and special regulations to be fixed in the statute. From these the council of administration selects one as director of the station. The director of the station serves for three years and may be reappointed. These will constitute the scientific council. The scientific council provides for the regulation of the station and collaborates in the preparation of the budget pertaining to the financial needs of single sections.

11. The assistants and librarian will be appointed by the council of administration according to the rules to be fixed by the statute. The council of administration also has charge of the appointment of all other of the station personnel.

12. The personnel according to 10 constituting the scientific staff must devote their entire time to the work of the station. The same laws governing civil employees will apply to them.

As the writer understands it, these proposed changes will not prohibit private subscriptions

for tables by either Italian or foreign institutions, and such tables may be taken as in pre-war times.

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RESOLUTIONS OF THE PAN-PACIFIC SCIENTIFIC CONFERENCE

II. ANTHROPOLOGY

1. *Need for Polynesian Research*

RECOGNIZING the necessity for the immediate prosecution of anthropological research in Polynesia, this conference calls the attention of governments, patrons of research and research foundations to this important scientific need. We

Recommend that the most prompt and efficient steps be taken to record the data necessary to the understanding of man's development in the Pacific area.

2. *Facilities for Instruction and Research in Anthropology*

Since there is urgent need both for anthropological research and the training of men and women therefore, and since experience has shown the advantage of close association between the graduate departments of universities and persons and institutions carrying on anthropological investigations, this conference

Recommends the creation of centers for the study of anthropology and original research therein, such centers to be developed by the expansion of university departments or the alliance of universities with other research institutions with the result that these schools of anthropology shall combine all the essential features of a museum, a research staff and a graduate school. And, further, because of the peculiar conditions under which anthropological data must be gathered necessitating both intensive field work in circumscribed areas extending over several years, and intensive synthetic work by men who are masters in many fields, thus requiring a number of men through a period of years, we therefore recommend the establishment of research fel-

lowships for linguistic research, such endowments being provided that these fellowships will attract the best men available and provide for uninterrupted work during an adequate number of years.

3. *The Bayard Dominick Expedition*

It is evident that fuller knowledge of the history and culture of the Polynesian race is essential to the solution of the ethnologic problems of the Pacific; and also that the opportunities for obtaining information are rapidly disappearing. It is therefore gratifying to learn that Mr. Bayard Dominick has conceived a plan for ethnological studies in the Pacific on a scale not hitherto attempted and has provided funds for the initiation of this research under the guidance of Yale University and the Bishop Museum.

Resolved that the commendation of the conference be extended to Mr. Dominick for his far-sighted interest and generosity and that assurance of good will and cooperation be given him.

Ships for Bayard Dominick Expedition

The Bayard Dominick expedition of the Bishop Museum is now in the field and the successful continuation of its work depends upon obtaining a ship suitable for the navigation of waters outside of established trade routes.

The conference invites attention of the United States government to the benefits likely to result from providing this expedition with a suitable vessel.

III. BIOLOGICAL SCIENCE

1 *Marine Biological Survey*

The necessity for conservation of natural resources has become imperative, since, in the case of the Pacific Ocean, certain economic marine species have been exterminated and others are in peril of extinction or grave depletion. Measures for such conservation must be based on an exact knowledge of the life histories of marine organisms. Knowledge of the biological, physical and chemical

phenomena of the Pacific Ocean is meager and wholly inadequate to serve as the basis for rational conservation measures; therefore be it

Resolved: (1) That the First Pan-Pacific Scientific Conference recommends that the governments of the several nations bordering on the Pacific Ocean cooperate, through their several agencies concerned in surveying and charting the sea, toward the collection, compilation and publication of data relating to the topography of the bottom, and the temperatures, salinities, acidities, currents and other physical and chemical properties of the waters of this ocean, fundamental to biological research and the improvement and conservation of the fisheries.

(2) That the Conference recommends that a comprehensive systematic biological survey of the Pacific ocean and its contained islands be prepared, with special reference to the economic fisheries problems and that the investigation be carried on in so far as possible through existing agencies, such agencies to be provided with the additional apparatus and facilities necessary, the investigation to be carried on under such cooperation as will prevent duplication of effort.

(3) That the Conference recommends that the several museums biological stations and other institutions engaged in biological investigations relating to the Pacific ocean, associate themselves for the purpose of exchanging information concerning past, current and proposed investigations, the exchange of facilities and personnel, the coordination of work and prevention of duplication in their respective activities. It is further recommended that a survey be made of the facilities afforded by the several institutions, said survey to cover material, equipment, environment and the personal qualifications of the respective staffs for supplying special information and working up material. It is further recommended that the National Research Council of Washington, D. C., be invited to undertake or arrange for such survey and that a committee of this Conference be appointed to represent the interests

of the botanical and zoological sections in this regard, the committee to be appointed by the Chairman of this conference.

(4) That the conference recommends that systematic statistics of the fisheries be collected and published annually and that such statistics be, as far as possible, uniform in character and in such detail as to methods of fishing and geographical distribution as to make them useful in fisheries administration and conservation. It is further recommended that the several governments provide for a joint commission for the arrangement of the details of such statistical compilations.

2. Recommended Investigations in Marine Biology

Because of the urgency or importance of certain investigations, this conference

Recommends: (1) The collection of *bottom samples from depths under 100 fathoms*, since these are not usually obtained by deep sea expeditions and can be readily obtained at anchorage by simple apparatus.

(2) The study of the *Brachiopod Faunas* above the 1,000 fathom line inasmuch as a knowledge of these Brachiopods supplies important evidence on the question of former land connections.

(3) A systematic and thorough study of *Pacific Ocean Algae* and of the conditions under which they occur and of the part they play in their environment; this could be obtained by means already employed for certain parts of the Pacific Ocean and would be of great scientific value.

(4) Because the Hawaiian Islands lie on the margin of the tropical seas, and therefore occupy a critical position for the study of the ecology of marine organisms, among which corals are important; and because data obtained from ecologic investigations in this locality would be of value to geologists in interpreting the conditions under which fossil faunas lived, the conference recommends a careful study of the ecology of the marine organisms of the Hawaiian Islands, and particularly a study of the corals and of the organisms associated with the corals on the reefs.

3. Land Fauna

The part played by living animals in the solution of many scientific problems in the Pacific is well recognized. The relationship of their present to their former areas of distribution and to that of extinct allied forms is the key to some of the geological problems; they have direct bearing upon many ethnological problems and they are the chief source of evidence upon which our ideas of evolution must be built. From a knowledge of the land fauna follow great economic advantages, such as the protection of the human race against many diseases and crops against pests.

Although in certain continental Pacific areas and some of the larger islands the land fauna is fairly well known, yet in none is our knowledge complete, and in some, such as Polynesia, it is very incomplete. The urgency for this work is great, as large areas are rapidly being swept of their native land fauna. Therefore this conference

Recommends: (1) That surveys, as complete as possible, be made of the land fauna, especially of those smaller islands in which the native fauna is fast becoming extinct, or is likely to be in the near future.

(2). That the attention of zoologists be called to recently made land areas due to volcanic activity and the importance of the study of ecological development with special reference to the appearance of animal life upon such areas.

(3) That, since land mollusks are an important group in zoogeography, recommends that material for a comparative study of the soft anatomy of land snails be obtained from all the high islands of Polynesia, Micronesia and Melanesia, and that faunistic collection be increased as far as practicable by examining islands not now known or only superficially collected over.

4. Ornithological Survey of the Pacific

The conference expresses its gratification at the fact that arrangements have been made by the American Museum of Natural History for the purpose of undertaking and carrying on a comprehensive and intensive ornitho-

logical survey of the islands of the Pacific Ocean, particularly those of the South Seas, and extends its thanks to those who have made provision for the expedition.

5. *Collecting Polynesian Land Flora*

Since a definite knowledge of the flora of Polynesia is absolutely essential to a proper understanding and correlation of numerous problems bearing on the life and origins of Polynesian peoples, problems of forestry, agriculture, ethnobotany, plant diseases, physiology, and ecology; since the original vegetation of some island groups is rapidly being destroyed, and since botanical exploration of Polynesia has been sporadic and in many regions incomplete, therefore the Pan-Pacific Scientific Conference

Recommends: (1) That botanical exploration of Polynesia be extended as rapidly as possible in order to assemble comprehensive collections with as complete notes as possible covering the scientific and economic aspects of Polynesian botany.

(2) That this work of exploration be carried on by existing agencies, by special botanical expeditions and by heads of non-botanical expeditions employing and supervising native collectors whenever feasible for the collection and preservation of botanical material.

(3) That material be collected in bulk—from ten to fifteen specimens of each species—with the object of distributing duplicate material to Pacific institutions and to the larger botanical centers of the world.

6. *Plant Ecology on Lava Flows*

Since new lava flows and other volcanic ejecta offer fresh terrane on the abode of life, therefore this conference

Recommends that studies be made of the stages of ecological development with special reference to the appearance of forms of plant life on new volcanic deposits following an eruption; and also of plants best suited to the speedy rehabilitation for agricultural uses of regions covered by such volcanic ejecta; and of the resistance of plants to volcanic fumes.

6. *Preservation of the Hillebrand Garden (Honolulu)*

Since the botanical garden of the late Dr. William Hillebrand, author of the *Flora of the Hawaiian Islands*, situated in the city of Honolulu, is one of the most remarkable gardens in the world, possessing as it does many unique and rare plants introduced into the Hawaiian Islands by Dr. Hillebrand, and since the conference believes that the preservation and perpetuation of this garden, which is threatened with destruction, would be a great benefit to botanical science, this conference recommends steps be taken to insure its preservation.

IV. GEOGRAPHY

1. *Topographic Maps*

The exploration of Pacific regions in many branches of science is handicapped by the almost total lack of topographic maps. There is scarcely any human activity which does not depend to a great or less degree upon a knowledge of the configuration of the land. This is especially true in such work as mining, railroad and highway extension, and maintenance, utilization of water resources of the world can not be discovered and utilized efficiently without maps.

Topographic maps of any given area should be adapted in scales, accuracy and details to the scientific and economic needs peculiar to the area.

The benefits derived from adequate topographic maps are far greater than their cost and this conference urges that plans be made for carrying on a topographic survey of the lands of the Pacific regions, and that this plan be designed to give uniformity of results. This conference commends the countries of the Pacific region for the work already done by them.

2. *Survey of the Shoreline and Coastal Waters*

A general hydrographic survey of the continental shelves extending off-shore to the one-thousand fathom curve and of the island platforms should be executed, in order to supply basic data essential to all research

work involved in the general scientific exploration of the Pacific ocean.

This survey should establish a system of horizontal and vertical control, determine shore line and adjacent topographic features in true geographic position, develop submarine relief, collect and describe the materials of the bottom, observe temperature and salinity and define vertical and horizontal movements of the water. The hydrographic bureaus of the nations of the Pacific, as now organized and operating, need only expand their equipment and extend their field to meet the requirements of this project. Closer cooperation is desirable in the interest of uniformity and to avoid duplication.

These results, in addition to their bearing upon research work, have such a great economic value to the shipping, fisheries, and other marine interests that the cost of the survey for the collection of the necessary data is relatively insignificant. It is stated in a recent publication of the United States Coast and Geodetic Survey that the vessels wrecked in the coastal waters of California, Oregon and Washington in the year 1917 on account of the incompleteness of the charts involved a loss which amounted to more than double the estimated cost of a complete hydrographic survey of those waters.

This unfinished state of the hydrographic survey along the west coast of the United States is not exceptional; few regions of the Pacific of any considerable extent have been thoroughly developed. This conference makes appreciative acknowledgement of the notable contributions made to the survey of the coastal waters of the Pacific by the several nations bordering thereon; but in view of the magnitude of the work and the length of time involved in its execution it commends this general project and urges its early execution.

3. *Use of Wireless Telegraphy in Longitude Determination*

This conference commends the use of wireless telegraphy for the improvement of determinations of the longitude of the islands in the Pacific.

4. *Magnetic Survey*

The general survey of the Pacific ocean should be continued to an early conclusion and provision made for such additional work as may be needed to determine annual and secular changes in the magnetic elements. The field of work should be extended to include the coastal waters, where the magnetic phenomena are complex, and their determination essential to many important interests.

Systematic operations under this project are a comparatively recent undertaking; but already excellent results have been obtained in the Pacific from the work of the Carnegie Institution.

The work is of immediate and vital importance to navigation, and surveying, in addition to its bearing upon the general subject of geophysics and this conference hopes that plans may be made for a complete magnetic survey of the Pacific region and that the work may be expedited.

5. *Physical Oceanography*

Oceanographic investigations yield results which constitute a basis essential for scientific exploration and research in the Pacific region, notably in meteorology, geology, botany, and biology. Moreover, such investigations are of importance to navigators in disclosing dangers to vessels sailing the ocean, and are of economic value in enabling vessels to save time and fuel in their navigation.

The present knowledge of the oceanography of the Pacific is deficient in every branch, and constitutes but a meager array of data scattered widely.

In the oceanographic investigation of the Pacific waters the configuration of the bottom should be determined, specimens of the bottom deposits collected and their thickness and stratification revealed, the physical and chemical characteristics of the water at different depths and times determined, and the horizontal and vertical circulation of the waters observed.

The field work involved in such investigations must be carried on almost entirely by the governmental hydrographic organizations

of the countries bordering on and contained within the Pacific ocean, owing to the great expense involved in creating new and special agencies, and because the governmental agencies have the personnel trained in this work. Those carrying on oceanographic surveys in the Pacific should avail themselves of the services and advice of individuals and organizations dealing with those branches of science depending upon the results of such surveys.

This conference feels that a systematic oceanographic investigation of the Pacific should be undertaken as soon as possible. The plan adopted should be designed to complete the survey of the most critical areas at an early date, and eventually the whole Pacific region.

6. *Meteorology*

Investigations in meteorology, or the physics of the atmosphere designed to lead to an accurate scientific knowledge of atmospheric phenomena are of recognized importance. Very little is known of the behavior of the upper air over the land, and still less over the ocean. The fundamental aspects of these phenomena are exhibited in their simplest manner over the greatest of oceans, the Pacific. Hence it is necessary to make meteorological observation over the Pacific for the use in studying the more complex condition over the land.

Moreover, the collection and prompt dissemination of marine meteorological data are of great benefit to humanity in carrying on its commerce and in weather forecasting which is now limited by a lack of synchronized uniform, meteorological data over great areas not within the customary track of vessels.

Observation at the place of origin of typhoons, hurricanes, larger cyclonic and anticyclonic areas, as well as the development, dissipation, oscillation, and translation of the same, are essential to successful forecasting and the study of ocean meteorology. Moreover the meteorological survey of these ocean areas has practical value; therefore the gov-

ernments bordering on the Pacific ocean are invited to carefully consider these matters with a view to increasing the number of meteorological vessel and land stations within the confines of this ocean and on its borders, especially the establishment of vessel reporting stations in somewhat fixed positions. In considering these matters, it is believed that special attention should be given to increasing the number of stations in the well known "centers of action."

The Pan-Pacific Scientific Conference commends the ocean navigation companies and their masters of vessels for the valuable assistance they have rendered the meteorological services of the various stations, and urges them to further cooperate especially in the matter of transmitting their weather reports by radiograph as well as by mail.

7. *Meteorological Station on Macquarie Islands*

Since the observations made at the meteorological station on Macquarie Island resulting in improvements in the accuracy of weather forecasting, this conference expresses the hope that observations at that station, interrupted by the war, may be resumed at an early date.

8. *Meteorological Station on Mauna Loa*

In view of the fact that Mauna Loa, Island of Hawaii, the highest accessible point in the central Pacific, offers exceptional opportunities for the exploration of the upper air, it is recommended that a station of the first order be established on its summit for continuous meteorological observations.

9. *Earth Tides*

The successful operation of the Michelson earth-tide apparatus at a station in the United States of America has furnished data from which the knowledge of the physical characteristics of the interior earth has been increased, and it is desirable that earth-tide stations be established in the Pacific region at widely separated points in order to discover whether the physical characteristics vary from place to place.

This conference hopes this work will be extended.

10. *Isostatic Investigations*

Investigations in the theory of isostasy have thrown much light on the subject of deviation from the normal densities in the outer portions of the earth, which is of importance in the study of geology, and in other branches of science.

Much can be added to our knowledge of this subject of isostasy by a mathematical reduction of existing field data, following well-known methods, which would involve only slight expense.

This conference urges, in the interest of geophysical and other sciences, the early reduction of existing geodetic data and the extension of geodetic field work to those regions of the Pacific where such data are now lacking.

This conference commends the Coast and Geodetic Survey of the United States, the Trigonometric Survey of India, and the Geodetic Survey of Canada for work they have done in isostatic investigations.

(*To be continued*)

BIOPHYSICS

THE need of liaison or coordination between the different but related branches of science is coming to be felt; and indeed may soon prove as great as the need of specialization. The physiologist has long been wont to consult the anatomist about the materials with which he deals, but though his subject consists largely in the physics of living matter, his contact with the physicist has been limited and often unsatisfactory. It is usually hard for the physicist and physiologist to speak the same language. Almost at the outset of the attempt at cooperation the physicist plunges into an entanglement of mathematical formulæ into which the physiologist can not follow him and from which he can not coax him out, and negotiations have to be broken off. The biologist—especially the physiologist—ought to be better grounded in physics, and the physicist would profit much if he knew something of the behavior of

living matter and the physical properties in which it so strikingly differs from inanimate matter. Physiologists, even from good laboratories, often reveal ignorance of the physical terms they use by such mistakes as calling a pair of electrodes "an electrode," or transposing the terms abscissa and ordinate. Many use the electric current without sufficient understanding of its behavior to avoid some of the pitfalls into which it may lead them. Physicists on the other hand are usually so drilled in the analysis of the behavior of inanimate matter, which best lends itself to mathematical treatment, that it is hard for their minds to cope with such things as colloids, ameboid motion of protoplasm, action currents in nerve and muscle, reflex inhibition, color sense and many other phenomena which present features peculiar to life. I have seen a physicist, attempting to reduce the nerve impulse to the laws of electrical conduction in insulated cables, greet the suggestion that one must reckon with the electro-chemical condition of the protoplasmic colloid, with the answer that this was merely to relegate the nerve impulse to the realm of things we know nothing about and therefore can not analyze, and that consequently it was better to ignore colloidal chemistry. Thus ignorance of a great field of significant knowledge led to setting aside the kernel of the whole thing. I have heard of physicists being quite incredulous when told of certain well-established facts concerning the behavior of electrical charges in colloidal matter. The physicist who might have his eyes opened and his understanding broadened by a careful examination of vital phenomena, is apt to think these things are too vague and too impossible of quantitative study to merit his notice.

Physiology has sometimes been divided into bio-chemistry and bio-physics. Most research in physiology to-day is concerned rather with the chemical side of the subject than the physical side. Physiologists have effected better coordination with chemists than with physicists. But the branches of physiology abutting on the field of physics are many, and possibly offer as great a wealth of knowl-

edge as those on the chemical side. For example there is the rich field of study concerning the permeability of cell membranes and the viscosity of protoplasm, subjects bearing intimately on the life and activities of all cells, and involving the methods of physics rather than chemistry; there is the study of stimulation and functional response in the excitable tissues, which, especially in its electrical aspects, requires much of the technique and knowledge of the physicist; there is the whole field of the special senses including physiological optics and color vision, all of which may properly be called biophysics; and there is the study of the effects of radiation of various sorts on cell structure and function. All these are large fields offering great possibilities of future development, into which the average biologist is but meagerly equipped to penetrate far without the aid of a physicist with whom he can cooperate in a state of mutual understanding.

How is the situation to be met? Undoubtedly most biologists—especially physiologists—would do more effective work if they had given more time to the study of physics, but it is a question how much time they can afford to divert from biological study for this purpose. The physiologist who tries to approximate the training of the professional physicist, will not have time to acquire the thorough knowledge of biology which he should have. The physicist who must first of all be expert in his own line, can not digress to explore the field of biology with the thoroughness necessary to see where his methods would yield a harvest of data valuable to biology and instructive to himself.

The best answer is probably to be found in cooperation between experts in the two fields. A well-trained physicist with more than average knowledge of biology, cooperating with a physiologist with a good elementary knowledge of physics, should make a team capable of doing valuable work in the field where physics and biology touch—the analysis of vital phenomena.

To this end there should be courses of instruction in biophysics adapted to bringing

together the workers in the two fields. Physiology as taught in the best laboratories offers the nearest approach to this which at present exists in most universities. But in physiology the biological side strongly predominates; the physical technique taught is crude compared with that of the trained physicist, and there is little attention given to physical theory. Moreover, physiology is usually taught in medical schools, where it is made to conform to the needs of the prospective physician. Thus it is treated as an applied science rather than as a pure science; it is not primarily adapted as a preparation for research.

A course is being developed at Harvard which, it is hoped, will prove a useful step toward meeting this need. It is offered by the physics department under the designation "biophysics." Through cooperation between members of the departments of physics, zoology, botany and physiology and the Cancer Commission, it is intended that this course shall serve the students of both physics and biology, introducing to the physicists those phenomena whereby living matter shows its chief differences from all other matter, and some of those applications of physics to biology which promise to add substantially to our knowledge, and enabling the biologists to learn something of those aspects of physics which it is most important that they should know.

ALEXANDER FORBES

HARVARD MEDICAL SCHOOL

SCIENTIFIC EVENTS

THE POWER RESOURCES OF CANADA

THE Canadian Commission of Conservation is issuing a series of reports upon the power resources of the Dominion, the latest being "Water Powers of British Columbia." According to a review in the *Geographical Journal* it is a large volume of over 600 pages, illustrated by maps and photographs, and it deals with the subject (so far as present knowledge goes) in an exhaustive manner. A "General Introduction" discusses the value of water as a natural resource, explaining the

complicated interrelations between the various uses—*e. g.*, for power, irrigation, navigation, fisheries, domestic supplies, etc.—drawing on the experience of the United States as well as that of Canada, and showing the need for common organization and communal supervision of the various users. A second chapter deals with "Water Power Data," and under this head are given facts showing the recent tendency, particularly marked in the United States, for the control of water-power to become concentrated in the hands of a few great and related groups of financial interests. Succeeding chapters describe the history and present position of legislative control, and most of the remaining part of the volume is devoted to the present utilization and the possibilities of water-power in the Province, and the physical conditions which determine them, *viz.*, relief (including storage facilities) and climate. In this connection a detailed description of the physical geography of each of the river systems is given, and numerous tables of stream-flow, precipitation, and temperature. The scope of the volume is therefore wider than its title would suggest. It may be noted that the surveyed sites give a total of about 3,000,000 H.P., but although this is an advance on earlier estimates, it does not take into account the fact that very large and important areas have been only superficially surveyed or are virtually unknown, nor does it allow for storage improvements.

Another publication of the commission deals with "Power in Alberta—water, coal and natural gas." It first enumerates the water-powers of the Province, which are mainly on the Bow River above Calgary and on the Athabasca River about 150 miles above Lake Athabasca, and then discusses the relative costs and advantages of water-power and steam-power. This leads to a consideration of the coal resources of Alberta. These are enormous, and the report states that they form 87 per cent. of the coal of Canada, and to show what that means one may add that, according to Memoir 59 of the Geological Survey of Canada, the total supply of the Dominion is 1,234,000 million tons, while that of the British Isles is only

190,000 million tons. Allowance has to be made for the facts that of the Canadian total about three quarters consists of sub-bituminous coal or lignite, and that three fifths of the Alberta supply belongs to this group. Making allowance for this, it still remains true that the fuel resources of Alberta are very much greater than those of Britain. Natural gas is at present locally important, but it has an uncertain future. The report ends with a note comparing various methods for the fixation of nitrogen by electricity, a matter which will be of importance when the prairie lands need cheap artificial manures.

FUR SEALS OF THE PRIBILOF ISLANDS

THE regular sealing operations at the Pribilof Islands closed for the season on August 10. The Bureau of Fisheries reports that telegraphic information is to the effect that in the current calendar year through August 10 there were taken on St. Paul Island 21,936 pelts, and on St. George Island, 4,042, a total of 25,978. Of the skins taken, 721 were from seals 7 years of age or older. The figures given are subject to slight correction when final reports are made. The fall killings, made chiefly to supply food for the natives, will add somewhat to the year's total.

The by-products plant which was operated in connection with the sealing operations on St. Paul Island produced approximately 1,800 gallons of oil and 29,000 pounds of meat or fertilizer. The operations of the plant were curtailed because of inability to secure a sufficient number of laborers from the Aleutian Islands.

During the present sealing season the bureau has utilized on St. Paul Island a number of native workmen from St. George Island. This was done without curtailing the proper take of sealskins on St. George. The transfer of the men from St. George to St. Paul was effected by the Coast Guard cutter *Bear* and the bureau's vessel *Eider*.

The Bureau of Fisheries further states that misrepresentations have recently gained currency to the effect that pelagic sealing operations are to be permitted shortly in the North

Pacific Ocean and Bering Sea. It has been alleged that the United State government is about to remove the restrictions on pelagic sealing and that great activity will soon be witnessed in the outfitting of vessels for carrying on the work. A newspaper has recently published an item which purports to give minute details. The statements therein are so misleading in character as to give rise to the impression that they were fabricated solely for the purpose of creating a sensation or of encouraging uninformed persons to engage in an illegal enterprise.

The truth of the matter is that pelagic sealing in the North Pacific Ocean, north of the thirtieth parallel of north latitude and including the seas of Bering, Kamchatka, Okhotsk, and Japan, is prohibited by an international agreement entered into in 1911 by the United States, Great Britain, Japan and Russia. The agreement is in perpetuity unless one or more of the parties thereto dissent. With the well-demonstrated benefits which accrue to all the governments concerned from the rational management of the fur-seal herds, there is little likelihood that any one will permit its citizens or subjects to resume at any time in the future the disastrous practise of pelagic sealing.

The United States and Canada cooperate fully in patrolling and protecting the Alaska fur-seal herd. U. S. Coast Guard vessels are ever on the alert to detect violations of the international agreement, and it is safe to say that any clandestine operations would come to grief in short order.

In the fiscal year 1920 the revenue to the United States government from the sale of fur-seal skins was \$1,457,790. Aside from the revenue to this government, the governments of Great Britain and of Japan share in the annual take of Alaska fur-seals to the extent of 15 per cent. each.

THE PROPOSED CALIFORNIA ANTI-VIVISECTION LEGISLATION

THE board of regents of the University of California and the trustees of Stanford University have united in a protest against the anti-vivisectionist initiative. They say:

The advance of sanitation, modern medicine and physiology and the teaching of biology all rest on animal experimentation. The control of epidemic diseases, the management of surgical operations and of childbirth, and the certification of milk and water supplies would be impossible without the knowledge gained by such studies. In fact, the whole structure of the present-day protection of the public from disease rests upon animal experimentation.

The University of California and Stanford University are vitally interested in this initiative measure since its passage would stop the research work now going on in their medical schools, hospitals and laboratories, and in the Bureau of Animal Industry. The studies on botulism in olives, which will not only save the ripe olive industry of the state, but many lives, would cease, as would likewise the manufacture of serum for the prevention of hog cholera, the preparation of vaccine for anthrax, and the various other measures that annually save millions of dollars and prevent great suffering among domestic animals. Even feeding on animals would be impossible.

No worse attack on the welfare of the state and on the right of the university to seek and teach the truth could be made. Every man, woman and child, every unborn babe, every domestic animal in the state will be affected if this measure becomes a law. It is unnecessary special legislation due to prejudice and misinformation. No one will tolerate cruelty to animals. The present laws of the state are drastic and quite sufficient to control any abuse. We know that there is no cruelty to animals in the laboratories of the universities. They are in charge of men and women of the highest character, who are unselfishly working to better the lot of their fellow men. Anesthetics are always used for animals in the laboratory in exactly the same way that they are used by surgeons in the operating room. The real object of the antivivisectionist is not the prevention of cruelty to animals, but the prevention of progress in science and medicine.

THE SIXTEENTH ANNUAL NEW ENGLAND INTERCOLLEGIATE GEOLOGICAL EXCURSION

THE sixteenth annual New England Intercollegiate Geological Excursion will be held in the vicinity of Middletown, Connecticut, October 8 and 9, 1920. There will be two parts to the excursion. Friday afternoon the Strickland pegmatite quarry, Collins Hill, Portland,

will be visited. The quarry has produced in recent years a greater variety of interesting minerals than any other in this locality, and is always an attraction to visiting mineralogists.

Saturday the party will devote its attention to the faulting within the Triassic valley. The fault-line between the Lamentation Mountain block and the Hanging Hills block will be the particular study. Step faults and drag dips are frequent along the fault-line and give clear evidence of the magnitude of the faulting movements.

On Friday evening Professor W. M. Davis will speak on the Connecticut Triassic area as a whole. Professor W. N. Rice will then outline the details of the Saturday excursion and Professor W. G. Foye discuss the pegmatite quarries in the vicinity of Middletown. Immediately before these talks a luncheon will be served to the visiting geologists by Wesleyan University.

A collection of minerals from the pegmatites including one of the largest known collections of uraninites in the country will be on exhibition.

A cordial invitation is extended to all teachers and graduate students of geography and geology in the high schools, normal schools and colleges of New England.

LECTURES ON ASTRONOMICAL SUBJECTS AT THE CALIFORNIA ACADEMY OF SCIENCES

THE first course of lectures to be offered this year by the California Academy of Sciences has been arranged and will consist of four or more lectures on astronomical subjects. Each lecture will be illustrated. The course will be as follows:

September 26. Dr. W. W. Campbell, director, Lick Observatory, Mount Hamilton, Calif. Subject: "The solar system."

October 3. Dr. A. O. Leuschner, dean of the graduate division, University of California. Subject: "Comets."

October 10. Dr. R. G. Aitken, astronomer, Lick Observatory, Mount Hamilton, Calif. Subject: "The binary stars."

October 17. Dr. J. H. Moore, astronomer, Lick Observatory, Mount Hamilton, Calif. Subject: "The nebulae."

SCIENTIFIC NOTES AND NEWS

DR. LEO S. ROWE, assistant secretary of the treasury and formerly professor of political science in the University of Pennsylvania, has assumed the directorship of the Pan-American Union at Washington, succeeding Dr. John Barrett, who has retired after fifteen years as head of the union.

At a meeting of the Society of Chemical Industry in New York City on September 27, the Grasselli medal was conferred on Dr. Allen Rogers, of the Pratt Institute. The presentation address was made by Professor M. T. Bogert.

PROFESSOR FREDERICK HAYNES NEWELL, head of the department of civil engineering at the University of Illinois and formerly director of the United States Reclamation Service, has resigned and will go to California.

DR. ERNEST W. BROWN, professor of mathematics in Yale University, is on leave of absence during the first half of the current academic year and is sailing for England early in October to be away for a couple of months. His address there will be Christ's College, Cambridge.

PROFESSOR CHARLES A. KOFOID, of the University of California, has returned to Berkeley from a tour of the British and French institutes of parasitology and tropical medicine. He delivered addresses at the British Association for the Advancement of Science on "Hookworm and human efficiency" and on "The neuromotor system of flagellates and ciliates and its relation to mitosis and the origin of bilateral symmetry." He was elected vice-president of the Zoological Section of the association and received the honorary degree of doctor of science from the University of Wales.

MR. E. C. LEONARD, of the division of plants, U. S. National Museum, who accompanied Dr. W. L. Abbott to Haiti in February for botan-

ical explorations, returned to Washington on July 30.

PROFESSOR JOSEPH F. ROCK, formerly professor in the College of Hawaii, Honolulu, has left Washington upon an extended trip of agricultural exploration in eastern Asia for the Office of Foreign Seed and Plant Introduction, U. S. Department of Agriculture, with which he has recently become connected.

At the congress of physiologists held in Paris last July under the presidency of Professor Charles Richet, the Americans in attendance were Professor G. N. Stewart, Western Reserve University; Professor Frederic S. Lee, Columbia University; Professor Graham Lusk, Cornell University; Dr. L. J. Henderson, Harvard University; Professor J. J. R. Macleod, Toronto University, and Professor Fraser Harris, Dalhousie University.

SIR WILLIAM MACEWAN has been elected president of the International Society of Surgery, whose next meeting will probably be held in London during the summer of 1923.

THE following officers of the Pacific Division of the Phytopathological Society of America have been elected and will hold office for two years: *President*, Dr. H. S. Reed, Riverside, California; *Vice-president*, Dr. J. W. Hotson, University of Washington, Seattle; *Secretary-Treasurer*, Dr. S. M. Zeller, Oregon Agricultural College, Corvallis, Oregon.

J. J. DAVIS has resigned as agent in charge of the Japanese beetle control project at River-ton, New Jersey, to accept a position as head of the departments of entomology of Purdue University and the Indiana Agricultural Experiment Station, effective on October 1.

MR. R. M. OVERBECK, geologist, has resigned from the U. S. Geological Survey to accept a position with an oil company.

THE *Proceedings* of the Washington Academy of Sciences states that while in charge of a Coast and Geodetic Survey subparty working in New Mexico, Mr. R. L. Schoppe was struck by lightning and seriously burned, but is recovering.

ACCORDING to the Berlin correspondent of the London *Times* Professor Einstein is so much disgusted by attacks made upon him by certain of his anti-semitic scientific colleagues that he may leave Berlin altogether. The *Tageblatt* makes a strong protest against the annoyance to which Professor Einstein has been subjected, which it describes as disgraceful. It says: "It is the duty of the Berlin University to do all in its power to keep Professor Einstein. Every one who desires to maintain the honor of German science in the future must now stand by this man." Professor Einstein himself makes a reply in the *Tageblatt* to his assailants. He ends by saying that it will make a singularly bad impression on his confrères to see how the theory of relativity and its originator are being traduced in Germany.

THE botanists of America have sympathized deeply with the eminent French bryologist, M. Jules Cardot, whose house at Charleville was wrecked and the most valuable part of his library and collections destroyed by the German invaders. Not only was this done, but M. Cardot's fortune was so impaired by the loss of property due to the war that, for the present at least, he has given up his studies and entered the service of the French Government of Indo-China. A portion of M. Cardot's library and collections valued at 10,000 francs has been acquired by the French National Museum at Paris. The museum contributed 5,000 francs, English bryologists and botanists 2,500 francs and members of the Sullivant Moss Society in excess of the other 2,500 francs. The success of the American subscription was due largely to the efforts of the secretary of the society, Mr. Edward B. Chamberlain.

ARMAND GAUTIER, long professor of biological and medical chemistry in the Paris School of Medicine and distinguished for his contributions to these subjects, has died at the age of eighty-two years.

DR. D. P. VON HANSEMAN, professor of pathologic anatomy at Berlin, has died at the age of sixty-two years.

W. P. RUYSCH, inspector-general of the public health service of the Netherlands and since 1912 president of the public health advisory council, has died at the age of seventy-two years.

PROFESSOR CELORIA, director of the Milan Observatory died on August 17, at the age of seventy-eight years.

THE *Observatory* announces the death of Professor A. Berberich, of the Astronomische Rechen-Institut of Berlin, sometime editor of the *Astronomischen Jahresbericht* and of Robert Philippovitsch Simon Vogel, professor of astronomy and geodesy in the Vladimir University in Kieff, and since 1901 director of the Kieff Observatory.

THE U. S. Civil Service Commission announces an examination for computer, Bureau of Mines, on November 3, 1920, to fill a vacancy in the Bureau of Mines, Pittsburgh, Pa., at \$1,500 a year.

THE eighth annual Indian Science Congress will be held in Calcutta from January 31 to February 5, 1921, under the presidency of Sir R. N. Mukerjee.

THE Carnegie Institution of Washington published on September 9, 1920, the second volume of the *Cactaceæ* by N. L. Britton and J. N. Rose. The first volume of this work was issued June 21, 1919.

MANY American nations, as well as Great Britain, Spain and Portugal, are to be formally invited to participate in the national festivities in November and December in commemoration of the four hundredth anniversary of the discovery of the Straits of Magellan. The festivities will center principally in Santiago and Punta Arenas, the latter the world's southernmost city, where the occasion will be marked by inauguration of important public works, including port improvements, lighthouses in Smith Channel, a highway between Punta Arenas and Natales on the South Atlantic coast and laying of a cornerstone of the Punta Arenas University. It is expected the foreign delegations will visit the straits in December, when warships of the Chilean navy will be assembled there. It was

through these waters that Ferdinand Magellan, the Portuguese explorer, first passed in November, 1520.

UNIVERSITY AND EDUCATIONAL NEWS

UNDER the will of the late Mrs. William J. Wright Harvard University has been left over \$23,000, to be known as the "William J. and Georgiana B. Wright Fund," the income to be used for medical research and the advancement of the medical and surgical sciences. A bequest of \$14,000 has been made by the late Dr. James Ewing Mears, of Philadelphia, for the maintenance of a scholarship in medicine and for the work of the Cancer Commission. Edwin F. Atkins, of Boston, has given \$12,000 for tropical research in economic botany.

DR. ROBERT WAITMAN CLOTHIER, professor of farm economics in the Mississippi College of Agriculture and Mechanic Arts, has become president of the New Mexico College.

AT Yale University Adolph Knopf, Ph.D. (California), from the U. S. Geological Survey, becomes associate professor of physical geology and petrology, and Robert A. Patterson, Ph.D. (Yale), assistant professor of physics.

PROFESSOR OSCAR H. PLANT goes to the University of Iowa this year as professor and head of the department of materia medica and pharmacology. Dr. C. S. Chase, who has been head of the department for many years and a member of the faculty since 1892, remains with the university as full professor in the department and will teach pharmacology and engage in research and writing.

DR. OTTO STUHLMAN, JR., formerly at West Virginia University, has been appointed associate professor in physics at the University of North Carolina, which has enlarged its physics staff since the completion of Phillips Hall, the new laboratory.

IT is reported in *Nature* that Dr. R. M. Caven has been appointed to the chair of inorganic and analytical chemistry in the Royal Technical College, Glasgow. This vacancy was caused by the transfer of Dr.

F. J. Wilson to the chair of organic chemistry in succession to Dr. I. M. Heilbron, who was recently appointed professor of organic chemistry in the University of Liverpool. Dr. Caven was for many years lecturer in chemistry at University College, Nottingham, a position he resigned to become Principal of the Darlington Technical College.

DR. HAROLD ST. JOHN, formerly assistant at the Gray Herbarium of Harvard University, has accepted an assistant professorship of botany at the Washington State College.

At the British Empire Forestry Conference in London Lord Lovat dealt with the question of education. According to the *London Times* he said that higher forestry education subsidized by the state had been carried on until recently at eight or nine educational centers. The Forestry Commission had arrived at the conclusion that the forest authority subsidies should only be granted to those centers of education and research which were directly required to carry out the state's forest policy. Educational centers are required for higher forestry education for the training of men who wished to take up forestry as a career, *i. e.*, the forest-officer class; for education in the theory and practice of woodland management for owners and managers of private woodlands; and for education in practical forestry for working foresters and foremen who intended to go in for state or private forest service. The Forestry Commission have therefore come to the conclusion that as far as state assistance went their interest should be confined to the following objects: (1) To assist in the establishment of the machinery (staff equipment and facilities) for a complete course of higher forestry education at one of the universities in the British Isles. (2) To subsidize certain specialized courses, of which forestry engineering should certainly be one, which could be taken as a post-graduate or fourth-year course at one of the other universities. (3) To be responsible for the payment of a lecturer in forestry at certain universities and colleges where adequate agriculture and estate management courses are

established, and to set aside sufficient state woodland for practical instruction. (4) Subject to certain payments by private owners, to be responsible for the establishment and upkeep of not less than seven or more than ten working foresters' schools.

A MEMORIAL has been presented to the German National Assembly urging the formation of an Imperial Chemicotechnical Laboratory, which it is recommended should be formed from the Military Test Bureau which existed during the war. *Nature*, quoting from the *Zeits. des Vereines deutscher Ingenieure* says that it is suggested that the functions of the new laboratory should be, *inter alia*, the execution of scientific and technical investigations relative to raw materials, and particularly (1) the production of materials of importance to the public, *e. g.*, spirit from wood and acetylene instead of from potatoes, and of fatty acids from the products of coal- or lignite-tar or paraffin, and the utilization and improvement not only of cellulose as a substitute for cotton, but also of ammonium nitrate obtained synthetically in large quantities as a fertilizer; and (2) the determination of substitutes for chemical and metallurgical products not available in the country or of which there is a shortage, *i. e.*, substitutes for paraffin, camphor, and glycerine, for substances used in the preservation of leather and metals, also substitutes for lubricants, rubber, gutta-percha, etc. In addition, the proposed new institute would carry out researches of general interest, *e. g.*, on rust-prevention and the corrosion of metals, on the determination of stresses in internal-combustion engines, on the effect of winter cold and the upper-air temperatures on implements and raw materials, and on the testing and improvement of aeroplane and airship fabrics. It is also suggested that scientific and technical investigations should be carried out dealing with the prevention of accidents and the protection of workers in a number of important industries.

WE learn from *Nature* that Mr. John Quiller Rowett has contributed £10,000 towards the endowment of an Institute for Research

in Animal Nutrition in connection with the University of Aberdeen and the North of Scotland College of Agriculture. The new institute, which will be named the Rowett Research Institute, has secured the services of Dr. J. B. Orr, the director, recently associated with Professor E. P. Cathcart in the conduct of a study of the energy output of soldiers, and Dr. R. H. A. Plimmer, chief biochemist in the institute, a research worker in the Physiological Institute of University College, London.

PROFESSOR GEORGE C. COMSTOCK, director of the Washburn Observatory of the University of Wisconsin, forwards the following extract from a letter to be published as a warning to prospective victims: "A short time ago, a man representing himself to be a nephew of yours and giving his name as Mr. R. L. Denny, of 64 Riverside Drive, New York City, obtained a loan of \$8.00 from me after putting up a good story of having lost his pocket-book, being a stranger in the city, etc. I have not heard of him since. I have reason to believe that he is a clever 'crook' working among college men."

THE British Ministry of Agriculture is arranging a series of investigations and exhaustive experiments with regard to certain aspects of foot-and-mouth disease, and for this purpose the Admiralty is placing obsolete warships at the disposal of the Ministry for use as floating laboratories. The ships will be fitted with every essential for the study of the disease, and it is understood that there is no intention of disclosing off which coast the ships will be stationed. An official of the ministry informed a representative of *The Times* that the experiments are to be carried out at sea to obviate any risk of the disease spreading from the experimental station. The investigators will include members of the staff of the ministry and other scientists, including several distinguished foreigners. In dealing with a disease of which the virus is presumed to be ultra-microscopical, and of which the contagion may be air-borne, the difficulties must be very considerable, and the research may last for years. A previous attempt was

made to solve the problem by sending a commission of investigation to India, where it was found that cattle were immune. The necessity of stamping out the disease, it was pointed out, is imperative, if England is to maintain her large cattle exports. Foreign buyers will not take the risk of purchasing cattle in England for transport to the Continent while the danger of foot-and-mouth disease exists. So contagious is it that a healthy animal, passing along a road that had been traversed twelve hours previously by an infected animal, may contract the disease.

DISCUSSION AND CORRESPONDENCE

THE BOUNDARY BETWEEN THE SILURIAN AND DEVONIAN IN SHROPSHIRE AND FRANCE

DURING the German occupation of Lille, Professor Charles Barrois and his able assistant, Dr. Pierre Pruvost, being confined to the city, busied themselves as much as was allowed studying the many undetermined fossils that had been accumulated during the past twenty years by various coal companies of the Calais basin. Not only this, but they also studied in greater detail the local stratigraphy, with the result that we now have a preliminary statement from them entitled "*Sur les couches de passage du Silurien au Dévonien dans le bassin houiller du Pas-de-Calais.*"¹ The complete work is to follow later.

The chief conclusion reached is that the line between the Silurian and Devonian should be drawn at the base of the lower Gedinian, which in the Ardois is the Bois-Bernard arkose immediately beneath the tentaculite shales of Méricourt; in the Ardennes and Brabant this is the conglomerate of Fépin, which lies at the base of the Mondrépits shale. To make this matter clearer, the authors also correlate the various horizons studied by them with those of Shropshire, with rather surprising results. All of the "passage beds" (Tempside shales at the top, followed beneath by the Downton Castle sandstone (= Tilestones), and the Ludlow bone-bed) are referred to the base of the Lower Devonian. The Silurian of the

¹ *Comptes rendus, Acad. des Sciences*, Vol. 167, 1918, pp. 705-710.

type area, therefore, ends with the *Chonetes* flags of the upper Ludlow.

These correlations have been accepted by L. D. Stamp for Shropshire and South Wales.² In southern Wales the *Grammysia* beds are regarded as transitional between the upper Ludlow and the lower Gedinnian, here the Trichrûg beds.

The evidence for drawing this boundary between the Silurian and Devonian systems is primarily based on diastrophism, though fossils have always been given full consideration, lithology being regarded as of least value.

It now appears clear that the black limestones of Bohemia known as the Ff beds, and the Tentaculite limestone or the Manlius of New York must also go into the Lower Devonian. Just where the division line in Maryland, Pennsylvania, and New Jersey will be drawn is, however, not so clear, for here there appears to be a more or less complete transition from the Silurian (Tonoloway) into the Manlius equivalent. The last worker on this problem, J. B. Reeside,³ was not able to adjust the matter.

CHARLES SCHUCHERT

THE MEASUREMENT OF POSTGLACIAL TIME

TO THE EDITOR OF SCIENCE: The proposal of DeGeer to measure postglacial time in North America by the lamination of glacial clays and its criticism by Fairchild are of special interest to phytogeographers who see in early postglacial migrations of plants the fundamental explanation of the present conditions of plant distribution. Fairchild has taken exception to some of DeGeer's statements, especially his estimate of 20,000 years for postglacial time, and has apparently adopted Taylor's computation of 75,000 to 150,000 years for the recession of the ice from Cincinnati to Mackinac. In this connection it is of interest to refer to a paper of DeGeer's published in 1908. In it he stated that the recession of ice in southern Sweden was as slow as 25 meters per year, rose to 130 meters, stopped for 100 to 200 years, began again at 20 meters, and gradually accelerated to 400

² *Geol. Mag.*, April, 1920, pp. 164-171.

³ Prof. Paper 108-K, U. S. Geol. Survey, 1917.

meters per year. If one assumes DeGeer's minimum figure of 20 meters as an average annual rate in Michigan and Ohio, 36,000 years would be sufficient to cause an ice recession from Cincinnati to Mackinac. Since this region is farther south and with less rainfall than Sweden, it is fair to presume that the rate was much more rapid. Assuming DeGeer's average figure of 200 meters per year, 3,600 years would have produced the same result. Neither is it necessary to invoke the precession of the equinoxes to explain the fifteen frontal moraines on the way. DeGeer states that frontal moraines were formed in Sweden during a stationary period of 100 to 200 years. Such periods may have resulted from cyclic variations in temperature, as DeGeer believes, or from similar variation in precipitation. The latter are of course well authenticated through the researches of Huntington and others. Allowing 400 years for such stationary periods, the total time of ice retreat over this distance is still within 10,000 years.

H. A. GLEASON

NEW YORK BOTANICAL GARDEN

EXPLORATIONS IN THE PANHANDLE OF TEXAS

THE third expedition to northwestern Texas and Oklahoma completed its labors about the first of July. This expedition found more than two hundred small stone buildings in groups scattered through a territory approximately 200 × 100 miles in extent. It appears that these are not distinct Pueblo type of architecture but rather mark the gradual evolution of a nomadic buffalo-hunting tribe of Indians to people who lived in stone dwellings. Near the Oklahoma line the buildings are small and rudimentary, and as one proceeds westward they increase in size and numbers. The art also develops. A preliminary paper has been published setting forth the observations on the artifacts, irrigation ditches, pictographs and buildings. These will be mailed free of expense to any interested persons by the author.

W. K. MOOREHEAD

ANDOVER, MASS.

QUOTATIONS

THE BRITISH ASSOCIATION AT CARDIFF

THE Cardiff meeting of the British Association for the Advancement of Science came to a successful end last night. Any attempt to follow, or, still more, to report, its proceedings in detail was baffled by the multitude of subjects covered, and the subdivisions of the association into specialized sections. There were eleven sections and one subsection at work simultaneously every day, to say nothing of a number of committees, subcommittees, and conferences. Some of the papers and discussions dealt with questions of the widest interest; there were others apparently admitted only to gratify individual readers or speakers, or to pander to notoriety. There was a notable tendency to combination of the sections for the discussion of borderland questions, and on every occasion where this took place the attendance at the combined meetings was much larger than the sum of the attendances at separate meetings. It is understood that such concentration has the sympathy of the council and officers. We trust that it will be encouraged, and we could wish that it would lead to a permanent fusion, at least for the purpose of the public meetings, of kindred sections. The general standard of the proceedings was highest in Section A, which has most successfully resisted subdivision, although it covers mathematics, astronomy, and the physical sciences.

The leading scientific feature of the meeting was the president's exposition of the need and advantage of increased study of the sea. The Lord Mayor expressed the hope that some of the merchant princes of Cardiff might be led to establish a department of oceanography attached to the university or to the National Museum of Wales. Far be it from us to offer advice that might chill local generosity. Hitherto private munificence has played a greater part in the encouragement of learning and research in America than in England and Wales. But oceanography requires expensive equipment. The chair established by Professor Herdman himself at Liverpool and

the station of the Marine Biological Association at Plymouth still need encouragement and support. Much better work might be accomplished by two good than by three indifferent centers. Although research must have a local habitation, its results are of universal benefit. If the hearts of the magnates of Cardiff warm to the science of the sea, their benevolence, although bestowed on Plymouth and Liverpool, would still assist the fisheries and the ocean traffic of their own city. But if local munificence must have an object characteristically local, there are many opportunities for research strictly bearing on other industries of South Wales.

The President made the interesting suggestion that the time had come to prepare a new "Challenger" expedition. He was supported by all the sections concerned, by physicists, astronomers, zoologists, botanists, geographers, and geologists, all of whom know of scientific and practical problems requiring investigation at sea. Mr. F. E. Smith, Director of the Admiralty Board of Research, at the conference held on Thursday afternoon, stated that the Lords of the Admiralty favored the idea, with the reservation that the whole cost of an expedition, which would have objects far beyond naval requirements, should not fall on the Navy Estimates. The original "Challenger" expedition was financed by the government, on the invitation of the Royal Society. From 1872 to 1876 the ship sailed all the oceans of the world, except the Indian Ocean, which the government of India wished to be reserved. The results were issued in fifty volumes issued from 1880 to 1895, under the guidance of the late Sir John Murray. By general admission the "Challenger" expedition was the greatest scientific exploit in aim and achievement undertaken before or since. But, like all scientific research, it showed the need of further research, for the deepest dredge can not bring up all the secrets of nature. The general committee of the British Association recommended their council to appoint a small expert committee to devise a program of work, and to consider the technical apparatus and the scientific staff

that would be requisite. Adequate preparation of a scheme may take several years, perhaps in the circumstances a fortunate delay. For a new "Challenger" expedition will be very costly, and we trust that the government and the national finances will then be in a better position to undertake what certainly should be a national enterprise.—The London Times.

SCIENTIFIC BOOKS

Principles of Animal Biology. By A. FRANKLIN SHULL, with the collaboration of GEORGE R. LA RUE and ALEXANDER G. RUTHVEN. McGraw-Hill Book Co., Inc., New York.

Most teachers of elementary zoology have for some time acknowledged that the almost exclusively morphological texts fail to give the beginner in the science a fair introduction to the field of zoology. Several recent texts and revisions of some of the older ones have endeavored to meet the demand for a more thorough treatment of the underlying principles of the subject. For one reason or another most of these attempts have failed to meet with general approval. In many instances they have remained predominantly morphological with intercalated sections on the principles. The *Principles of Animal Biology* by Shull, La Rue and Ruthven promises to meet the requirement for a text dealing with the fundamental biological principles far better than any other that has appeared to date.

Throughout the text there are brought together distinctly modern view points regarding the various subsciences of zoology. The book is not only well written so that the reader is fascinated by the smoothness of the narration but in addition it has all appearances of being so organized that it may be easily assimilable by the beginning student. In only a few instances does the treatment seem to be beyond the grasp of the average student. In the discussion of the physiology of cells (Chapter III.) the extent of chemical knowledge assumed to be possessed by the student is rather great. The structural formulas and the

highly technical chemical terminology would not be intelligible to the average freshman, but this is not any fundamental criticism of the book for most teachers are coming to realize that a certain amount of consideration must be given the unusual student.

The book is distinctly the result of a reactionary movement away from the more stolidly morphological and taxonomic treatment of the subject of zoology. A point might be raised as to whether it is not possible that the taxonomic aspect has been curtailed to the extent of impoverishing the opportunity of citing comprehensible instances of the principles for the average student. Correlation of laboratory work and text assignments might easily obviate this possible difficulty. Content of an elementary course and the relative emphasis to be placed upon the various phases of the science are by no means matters of universal agreement among zoology teachers. Consequently a criticism like the foregoing may in the end prove to be either a valid judgment of the text or an ultimate criticism of the one offering it.

H. J. VAN CLEAVE

UNIVERSITY OF ILLINOIS

SPECIAL ARTICLES

PRELIMINARY INVESTIGATION OF RIBES AS A CONTROLLING FACTOR IN THE SPREAD OF WHITE PINE BLISTER RUST¹

Most authorities will now admit that the complete eradication of the white pine blister rust from the country is not possible, but they consider it both possible and feasible to control the disease to a certain extent and to protect certain definite areas of pine. It is also agreed that such protection must be exercised through the eradication of *ribes*.

Under these conditions, the control of the white pine blister rust, or rather the protection of the white pine, depends on a definite knowledge of the habits of *ribes*, especially of the wild plants, and their reactions to different treatments. Projects were there-

¹ Published with the approval of the Director as Paper No. 209, of the Journal Series of the Minnesota Agricultural Experiment Station.

fore planned and working plans drawn up to cover the following points.

For the purpose of these projects the land was classified into swamp, moist and dry.

PROJECT I

To study the sprouting of different species of *ribes* eradicated in different months and under different moisture conditions.

In the land which was cleared in May twenty-five bushes were located in dry ground and twenty-five in moist. No swamp was worked. These bushes were marked with numbered stakes and exactly located on a map.

The following data was noted for each bush: (a) whether plant was pulled or grubbed; (b) whether part of crown was left or only side roots; (c) whether sprouts came from the crown, the cut ends of side roots, or as suckers from the roots; (d) number of sprouts, date of sprouting and species.

This same schedule was duplicated on areas cleared in June, July, August and September.

Bushes were selected which were eradicated about the middle of the month, so that the intervals were about even.

PROJECT II

To study the cost and effectiveness of eradication of *ribes* in different months.

Five quarter-acre plots were laid out in dry land—either brush or forest land—not meadow or tilled land—in the area eradicated in May. The same was done on the moist land type.

This schedule also was repeated in June, July, August and September.

These plots were permanently marked with stakes, as they will probably be studied for the next three or four years at least.

After the eradication crew had gone over this area, the plots were carefully examined to see what was left. The plants found were classified by species as sprouts, seedlings under six inches, and old plants.

PROJECT III

To determine the number of years eradication will have to be practised.

The plots established for Project II. will

be studied for a series of years, and the development of the *ribes* noted.

PROJECT IV

To study the reproduction of different species of *ribes* by seed and layering.

A number of plants of each species were located in both moist and dry types in pine woods, in hardwoods, in brush land, in sod land and in swamps.

Seed was collected from each species at weekly intervals and in all stages of maturity. Some of it was tested at once for germination, some was stratified and held for germination tests in the spring.

Plots of seedlings were staked out and counted from time to time and survival noted. They will be checked again in the spring to see how many were winter killed.

PROJECT V

To determine the effect of pruning and cutting off the roots at different depths and different dates.

A number of bushes of each species were located both in the dry land and moist types.

Some of these were cut off above the crown, some just below the crown and some six inches below the surface.

This was done in June and duplicated in August.

PROJECT VI

To determine growth habits of each species.

A number of plants were located and put under surveillance. Their future development will be studied.

The infected area around Rush Lake, Minnesota, was selected for the experiments. Eradication of *ribes* had been carried on there in the summer of 1918 and was in progress during the summer of 1919. It is a rolling country of hills, and swamps. All stages of cultivation are represented from wild woodland, through brushland and pasture, to cultivated fields. Most of the woodlands are made up of mixed hardwoods—butternut, red oak, white birch, bitternut, hickory, basswood, sugar maple and white ash, with a large mixture of black ash in the lowlands. Here and there is a small patch of pure white pine and

in many places there are a few white pine scattered through the hardwoods and pastures.

The ground cover is grass, goldenrod, blueberries, blackberries, raspberries and the common roadside weeds. The brush on the highland is prickly ash and hardwood reproduction with zones of dense alder and raspberries around the edges of the swamps. The soil is mostly sandy loam, rather light.

Five species or *ribes* are common there. *R. cynosbati* predominates on the dry lands. *R. oxyacanthoides*, *R. floridum*, *R. triste* and *R. prostratum* occur in the swamps in the order named.

The results of the first season's work under this program are interesting and significant, but not conclusive. The data in many instances was found to be too meager and at least one more season's work will be necessary before any very positive statements can be made, but there are some very strong indications.

There was a decidedly higher percentage of sprouts from the plants eradicated on the moist type than on either the dry or the swamp type. In fact no sprouts at all were found on either *R. triste* or *R. prostratum* in the swamps. This would seem to indicate that more sprouting might be expected from plants on the dry land type in a very wet summer than in a dry one.

There was a larger percentage of sprouts from the plants which were grubbed than from the plants which were pulled. It was significant that a majority of the sprouts on pulled plants came from the root ends, while a majority of those from the plants grubbed out came from pieces of the crown which were left. Only two root sprouts from grubbed plants were found. In no case, either from pulled or grubbed plants, were there any root sprouts, *except where the root ends were exposed to the light*.

The tendency to sprout from the root ends seemed much stronger in plants pulled in May and June than late in the summer. Possibly this was due to the greater moisture in the ground in the spring months. This did not apply to crown sprouts which seemed to

develop equally well in any month of the summer.

Where plants were cut off above the crown they almost invariably sprouted in all types and at all seasons with the exception of the swamp species, *triste*, which showed very little tendency to sprout at all. Plants cut off below the crown showed very little tendency to sprout. In fact the only sprout found was on a root end which was dragged to the surface in the process and left exposed to the light.

A study of the plots laid out in the eradicated area seems to indicate that there is very little difference in the efficiency of radication in the dry, moist, or shallow swamp types, while the number of plants left in the deep swamp is hopelessly large. The eradication done in May and June seemed much less effective than that of July and August, but this may have been due to the fact that the crews were inexperienced at the start.

The number of large plants missed by the eradication crews was very small, representing on the average far less than five per cent. of the original stand.

The number of seedlings missed is naturally very much larger, but their leaf surface is very small, none of them were found to be infected and it is questionable whether they live over to the second season in very large numbers. Plots of seedlings counted in July and August and checked late in September showed a decrease of 25 per cent. while very few two-year-old seedlings were noted anywhere.

Up to December 1 no germination had been obtained from any of the seed collected the summer before.

CONCLUSIONS

Incomplete as this study is it seems to indicate an important change in the method of eradication. The number of large plants missed is very small, the number of seedlings, though large, is not excessively large, and the sprouts make up a very large per cent. of the leaf surface on eradicated land. If it is true, as this study indicates, that practically all of

the sprouts come from pieces of crown and from root ends which are exposed to the light, the sprout can be eliminated by careful practise in eradication. Cutting of the roots would seem to be more effective than pulling: ordinary care will prevent the leaving of pieces of crown in grubbing, while only extraordinary care and considerable work can prevent the leaving of exposed root ends after pulling. In the past it has been the custom in this state to pull whenever possible and to grub only as a last resort. It looks as though the practise should be reversed. The initial work may be a little more expensive, but it will be cheaper in the end if it eliminates the sprouts which make up the great bulk of the growth on eradicated areas.

According to the figures obtained the eradication crews attained an average efficiency of almost 99 per cent. on old bushes and seedlings. If the sprouts can be eliminated the reduced leaf surface should certainly give a large measure of protection if not complete exemption from the disease.

E. G. CHEYNEY

UNIVERSITY OF MINNESOTA

THE AMERICAN CHEMICAL SOCIETY.

XI

DIVISION OF AGRICULTURAL AND FOOD CHEMISTRY

C. E. Coates, *chairman*

T. J. Bryan, *secretary*

Louisiana molasses and syrup: C. E. COATES.

The use of refined edible lactic acid in food products: GEORGE DEFREN.

Preliminary feeding experiments with pigs to determine the nutritive value of the amino acids of the proteins of feeding stuffs: H. S. GRINDLEY.

Proteins of pecans: C. T. DOWELL.

Body fat of hogs fed on peanuts: FRED H. SMITH.

An accurate and rapid dry combustion method for the simultaneous determination of soil organic matter and organic carbon: J. W. REED.

The actual carbon content of soil organic matter and its relation to the use of conventional factor: J. W. REED and R. H. RIDGELL.

Limitations of the white rat as an experimental animal: W. D. RICHARDSON.

Mammalian vs. Avian dietary experiments: W. D. RICHARDSON.

The ether insoluble hexabromides of pure and adulterated linseed oils: HERBERT BAILEY and W. D. BALDSIEFEN. Several modifications of the various methods which have been proposed from time to time for the determination of the hexabromide value of oils have been studied. As a result of this work a new method has been developed which, it is believed, is as accurate as any of those previously proposed, and more simple than most of them. The hexabromide values of a number of samples of pure linseed, soya bean, and other oils, and mixtures of linseed with soya bean oils have been determined.

The relative nutritive value of alfalfa as a supplement to a diet of corn and tankage, and kaffir and tankage: J. S. HUGHES and E. F. FERRIN.

Data on bacterial counts of beverages in Missouri: JAY BARTON. Excluding 23 samples from 3 different plants which were in an appalling condition, the average count for the remaining 203 samples is 71 per cubic centimeter. The three worst plants were in towns of population 5,000 or less. The average count of all samples from each of three other plants was between 100 per cubic centimeter and 150 per cubic centimeter; these plants were located in cities of 40,000 or more. *B. coli* were found in 8 samples collected from 5 plants. Only one of these plants was in a small town; the other four were in cities of 75,000 or more. *B. coli* were found in all of the products from one company manufacturing imitation wine. "Fancy" ginger ale (4 samples), grape juice (8 samples) and dealcoholized beer (80 samples) run uniformly good, about half of the samples containing no organisms growing at 37° C., and not more than 5 per cent. containing more than 10 per cubic centimeter.

The occurrence of hydrocyanic acid in Sudan grass and its effect on cattle: C. O. SWANSON. Samples of Sudan grass taken from a pasture where cows were feeding showed that large amounts of hydrocyanic acid was present, but no ill effects were observed. Sudan grass which was reported to have killed cattle did not apparently contain more of the HCN than the grass from the pasture mentioned. Conditions which favor enzyme action liberate hydrocyanic acid. Frosted Sudan grass gave a stronger test than that not frozen, but the HCN disappears very rapidly when the plant thaws out and dries. Ensiling favors the liberation of

the HCN. The tests must be made on the grass immediately after cutting, as the HCN was generally absent after the grass was wilted.

Effects of alfalfa on the sulphur content of the soil in comparison with grain crops: C. O. SWANSON and W. L. LATSHAW. Samples were taken from 86 fields and analyzed for sulphur. The plan was to select fields which had been in alfalfa for a long time, twenty to thirty years. Near these fields were found soils of the same type which were in native sod or had been cropped to grain since broken, about forty years. On the basis of annual rainfall the state of Kansas may be divided into three sections: humid, where the rainfall is 30 inches or more; the subhumid, where the rainfall is less than 30 inches but more than 22; the semi-arid, where the rainfall is less than 22 inches. In the humid section the average per cent. of sulphur was: alfalfa soil, 0.029; virgin sod, 0.035; cropped soil, 0.027. In the sub-humid section: alfalfa soil, 0.043; virgin sod, 0.045; cropped soil, 0.041. In the semi-arid section: alfalfa soil, 0.035; virgin sod, 0.038; cropped soil, 0.027. The growing of crops has decreased the sulphur content of the soil, using the virgin sod as the basis of comparison: Alfalfa, 16.5 per cent.; grain, 20 per cent. This is for the humid section. For the sub-humid section the losses are: alfalfa, 4.7 per cent.; grain, 9.3 per cent.; for the semi-arid section the losses are: alfalfa, 7.4 per cent.; grain, 30 per cent. The sulphur content of the soil is approximately the same as that of phosphorus. Chemical analyses of these soils do not show any appreciable loss of total phosphorus, while the loss of sulphur is next to nitrogen and carbon in magnitude.

The preservation of fish frozen in chilled brine: (I.) *The penetration of salt:* L. H. ALMY and E. FIELD. Several species of fish were frozen by immersion in sodium chloride solutions of different concentrations and temperatures and for varying periods of time. Salt penetrated the skin and superficial tissue under all experimental conditions. Freezing of fish in brine at the temperature near which ice begins to separate from the solution did not prevent the penetration of salt. Though it was possible to detect penetrated salt by chemical means, the amount of salt absorbed was not sufficient to influence the taste of the cooked product. A study is being made of the relative keeping of fish frozen in air and in brine.

Research on hypnotics: E. H. VOLWILER. The most commonly used hypnotics at the present time

are barbital, formerly known as veronal, luminal, adalin, diallylbarbituric acid and several others. Of these compounds, barbital is by far the most commonly used and is manufactured in this country in very large amounts. Recently some research has been carried on by The Abbott Laboratories, which is the principal manufacturer of barbital, to produce a better hypnotic. Among others, di-butyl barbituric acid and benzyl-ethyl barbituric acid have been prepared. Di-butyl barbituric acid shows promise of being valuable, its toxicity being somewhat less than that of barbital and several objectionable side effects being eliminated.

Wood alcohol and prohibition: CHARLES BASKERVILLE. Wood methyl alcohol poisoning is a unique problem in that it involves not alone physiological changes and technical matters having to do with production and distribution of the toxic agent, but sociological factors as well, for it is closely knit to prohibition. The pure substance so closely resembles ethyl hydroxide that it requires an expert chemist to determine the difference. As ethyl hydroxide was the constituent of the quondam beverages, the name without the qualifying words is liable to be misleading to those not informed. In view of that, and numerous other factors, it is urged that the name "methyl hydroxide" or "methanol" be applied to wood alcohol, and the name "ethyl hydroxide" or "ethanol" be applied to the so-called grain alcohol in an effort to render the use of the word *alcohol* itself obsolete. This can not be accomplished by legislation or immediately, but by common agreement in usage, especially in the chemical and pharmaceutical professions.

CHARLES L. PARSONS,
Secretary

(To be continued)

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